CHEMICAL AND BIOMOLECULAR ENG. (ChBE) 412
THERMODYNAMICS II – Spring 2017

Section 1: MWF 10-10:50 Location: DCH 1046
Section 2: MWF 11-11:50 Location: DCH 1046

Professors: Walter G. Chapman (wgchap@rice.edu) Office: B-241 in Abercrombie Lab
Francisco Vargas (fvargas@rice.edu) Office: B-228 in Abercrombie Lab
Office Hours: Chapman: 5 – 7 pm Monday
Vargas: TBA
TA: TBA

Text: Smith, Van Ness, and Abbott, Intro. to Chem. Eng. Thermodynamics, 7th Ed.

Homework, in Class Problems, and Computer Problems: 20% of your final grade
Computer Problems (1 or 2): each worth the same as 3 homework sets
Class Participation and Attendance: 5% of your final grade

Quiz 1 – Feb. 25, 9 am – noon: Closed Book. Worth 20% of final grade
Quiz 2 – Apr. 8, 9 am – noon: Open Book. Worth 20% of final grade
Final: TBA Open Book. Worth 35% of final grade

Lecture Topic	Lecture No.	Chapters
Vapor Liquid Equilibrium (VLE), Phase Diagrams, Raoult's law, Corrections to Raoult's law, K-Values, Flash Calculations	1-6	10, 11
Thermodynamics of Mixtures, Phase Equilibrium Criteria, Partial Molar Properties, Non-ideality in the Vapor and Liquid Phases, Azeotropes	7-14	11
Gibbs-Duhem Equation, Phase Rule, Henry's Law, Heat of Mixing	15-17	10, 12
Phase Stability, Liquid-liquid Equilibrium, Solid-liquid equilibrium	18-24	14
Phase Equilibria from Equations of State	25-27	14
Chemical Equilibria: Homogeneous, Heterogeneous, and Multiple Reactions	28-33	13
Introduction to Binary Separations	34-39	Notes Provided
Special Topics: Statistical Mechanics, Molecular Simulation	40-42	16, Notes Provided

Honor Code:

- Students are encouraged to talk to each other, the teaching assistants, and the instructor about any homework assignment in the course that is not specifically designated as pledged. This assistance is limited to the discussion of the problem and perhaps sketching of a solution. Consulting another student's solution (even from a previous class) is prohibited, and submitted solutions to assignments may not be copied from any source.
- You are forbidden to look at old tests. Example test problems for study will be provided.
- The quizzes and attendance sheets are covered by the Rice honor code policy, and as such it is a violation of the honor code policy to misrepresent your signature or the signature of another student on a quiz or attendance poll. Do not sign for another student.

Information about the Rice Honor System can be found at http://honor.rice.edu/

Late Penalties

- All assignments are expected to be submitted no later than the posted deadline unless an extension is approved well in advance by the instructor.
- Any assignment submitted later than the posted deadline will receive a penalty of 10%. For each 24 hours after the posted deadline, an additional 10% penalty will be added.

Attendance

- In accordance with the policy stated in the general announcements, attendance is required. Attendance is important for successful completion of this course. If any extenuating circumstances prevent your attendance, you are expected to notify the instructor by email in advance.
- If medical or other circumstance make advance notification impossible, you are expected to submit justification for your absence in writing. Unexcused absence will result in a zero score for any quizzes or a reduction in the participation grade. Those excused from class are still responsible for all handout and lecture materials.

Special Needs

- Any student with a disability requiring accommodations in this course is encouraged to contact me after class or during office hours. Additionally, students should contact Disabled Student Services in the Ley Student Center.

CHBE 412 – Thermodynamics II

Course Objectives

Students will learn to:

1. Understand the thermodynamic relationships among mixture fluid properties
2. Understand the molecular basis for ideal and non-ideal systems
3. Understand thermodynamic stability as applied to phase splitting
4. Apply thermodynamics to multicomponent-multiphase equilibrium
5. Develop a feel for the range of applicability of various correlations
6. Understand the thermodynamics of chemical reacting systems
7. Apply combined phase and chemical equilibria to chemically reacting systems
8. Apply this knowledge to problems of industrial application

Course Outcomes

Students will be challenged to

1. Calculate changes in thermodynamic properties on mixing
2. Relate mixture properties to thermodynamic derivative properties
3. Correlate phase equilibria data using excess Gibbs free energy models
4. Calculate phase equilibria from an equation of state
5. Calculate the conditions of phase splitting and solve problems involving multiple condensed phases
6. Calculate chemical reaction equilibria for non-ideal systems
7. Calculate multi-component phase and chemical equilibria
8. Analyze simple problems involving distillation and VLE behavior

Program Objectives for the B.S. in Chemical Engineering

1. Obtain the necessary knowledge in mathematics, basic sciences, computing, and engineering that will enable them to solve problems in the analysis, design, optimization, and control of components, systems, and processes encountered in the practice of chemical engineering;
2. Exercise their competence, creativity, and imagination in design and research, both as individuals and in teams, and apply their broad-based knowledge to synthesize solutions to realistic multidisciplinary engineering problems;
3. Cultivate effective communications skills, both oral and written, especially in technical subject matters;
4. Understand and appreciate the professional and ethical responsibilities entailed in engineering practice and research; and
5. Acquire a sufficiently broad, diverse, and rigorous education to excel in interdisciplinary industrial and graduate work in chemical engineering as well as in a variety of other professional degree programs.